

Remarks

Claims 15 - 34 are pending. Favorable reconsideration is respectfully requested.

Claims 21 and 22 were objected to but indicated to be allowable if rewritten in independent form including all the limitations of the base and any intervening claims. Accordingly, claim 21 has been amended by inserting the subject matter of claims 15 (base) and 18 (intervening). Claim 22 is dependent on now-independent claim 21 and hence both these claims should now be allowable.

Claim 15 has been amended to recite that the "A" linking groups are $N(R^3)\text{-CO-O}$ or $O\text{-CO-N}(R^3)$, both urethane groups, or $N(R^3)\text{-CO-N}(R^4)$ group, a special urea group where R^4 is a C_{6-18} aryl group, as disclosed in claim 18. The term R^4 has been used to distinguish this particular substituent from those of the prior claim (R^3). Claim 18 has been similarly amended. In claim 15, the spelling of "relative" (humidity) has been corrected. None of these amendments raise any issue of new matter.

The subject invention is directed to curable polymer compositions where a base polymer is terminated with alkoxysilylmethyl groups, where the methyl group is attached to a urea or urethane group. It has been recently discovered that such polymers have extreme reactivity as compared with polymers terminated with conventionally used alkoxysilylpropyl groups. The latter polymers had always been readily accessible by reaction of isocyanate-terminated prepolymers with the common γ -aminopropylalkoxysilanes, or by reaction of amino-terminated prepolymers with isocyanatopropylalkoxysilanes, the latter being prepared by reaction of aminopropylsilanes with phosgene. The precursors for methylene-linked alkoxysilyl groups, such as isocyanatomethylalkoxysilane and aminomethylalkoxysilane were either not available commercially, or available only at relatively high expense, and thus those skilled in the art did not prepare the correspondingly terminated polymers, likely because they expected their reactivity to be similar to other alkylene-linked alkoxysilanes. However, it turned out, as discussed on pages 1 - 2 of the present application, that this was not the case;

the methylene-linked alkoxysilane terminated polymers react extremely fast, and are so reactive, in fact, that water scavengers such as vinyltrimethoxysilane are useless, because the polymers react much more quickly with traces of water than the water scavengers. The reaction is indeed so fast that the polymers are virtually impossible to handle commercially, as explained in the specification at the top of page 4 and in the first paragraph of page 5.

Applicants surprisingly discovered that this high degree of reactivity is due in large part to acidic and basic contaminants which accompany the preparation of the polymers. If these contaminants are neutralized or removed, or if novel means of preparing the polymers which do not generate these acidic or basic contaminants are used, storage stable compositions with long shelf life can be prepared. However, when catalyzed, these same compositions can be made to cure rapidly. As discussed in the specification, for example, page 7, first full paragraph, all prior methods of preparing polymers with methylene-spaced alkoxysilane end groups retain or generate acidic or basic compounds.

Claims 15 - 20 and 23 - 28 have been rejected under 35 U.S.C. § 102(b) as anticipated by Müller et al. U.S. Patent 5,118,290 ("*Müller*"). Applicants respectfully traverse this rejection.

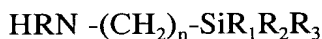
The claims require that the polymer composition exhibit a skin formation time > 40 minutes at 23°C and 50% relative humidity in the absence of a catalyst. In such polymer compositions, it should be noted that the skin always cures first, while the inside takes much longer to cure. The claims also require that the composition have a skin formation time of less than 20 minutes following addition of 3% or less by weight of catalyst.

Müller is directed to dental impression materials, which, by their nature, must cure rapidly (one does not sit in a dental chair for > 40 minutes waiting for an impression material to cure)¹. Moreover, the *Müller* products contain only urea-linked alkylalkoxysilane

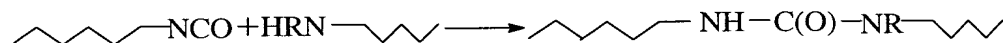
¹ Moreover, the present claims require skin formation in uncatalyzed compositions of > 40 min., while dental impression materials must cure throughout, otherwise the accuracy

end groups; no urethane-alkoxysilane end groups. The *Müller* products are prepared by methods typical of polyurethane prepolymer preparation, where a hydroxyl-functional polyether is reacted with isocyanate to form an isocyanate-terminated polyurethane prepolymer. The prepolymer may also include moieties derived from low molecular weight diols (chain extenders) and diamines, providing additional urethane (short/hard segment) urethane and urea groups.

Once the prepolymer is formed, the alkylalkoxysilane end groups are provided by reaction with an aminoalkylalkoxysilane of the formula



where R is H or $-(\text{CH}_2)_n-\text{SiR}_1\text{R}_2\text{R}_3$, R_1 is C_{1-4} alkoxy, and R_2 and R_3 are C_{1-4} alkoxy, methyl or ethyl (column 2, lines 30 - 65). The reaction of an HRN-functional compound with an isocyanate can only generate a urea linkage:



No urethane groups can be generated.²

In contrast, the majority of the polymers within the scope of Applicants' claims contain urethane-linked end groups, not urea-linked end groups. The sole exception are the polymers which contain the $\text{N}(\text{R}^3)\text{-CO-N}(\text{R}^4)\text{-}$ linkage, where R^4 is a C_{6-18} aryl group³. However, *Müller* does not disclose any such compounds, since the amine substituent R in

of the impression and subsequent castings prepared therefrom will be compromised.

² The prepolymers of *Müller* may contain 0.5 to 10 parts by weight of urethane groups, but these are internal to the isocyanate-terminated prepolymer precursor, brought about by reaction of diisocyanate with the hydroxyl-functional polyether or chain extender. There are no urethane-lined end groups, nor could there be.

³ Claims 29 - 34 do not contain urea-linked end groups.

Müller's aminoalkylalkoxysilanes can only be H (i.e. $\text{H}_2\text{N}-(\text{CH}_2)_n - \text{SiR}_1\text{R}_2\text{R}_3$) or $-(\text{CH}_2)_n - \text{SiR}_1\text{R}_2\text{R}_3$ (i.e. $\text{R}_3\text{R}_2\text{R}_1\text{Si}-(\text{CH}_2)_n - \text{NH}-(\text{CH}_2)_n - \text{SiR}_1\text{R}_2\text{R}_3$). Since *Müller* does not disclose any polymers with urethane-linked end groups, and as he further discloses no urea-linked end groups of Applicants' claims, the rejection over *Müller* must be withdrawn.

Moreover, it is noted that *Müller* prepares his alkylalkoxysilane end group polymers in exactly the manner which produces acidic or basic (basic in this case) by-products. As indicated on page 7 of the present application, when this method is employed, traces of unreacted aminosilanes are always present, and these act as basic catalysts to such an extent that the cure rate cannot be controlled. *Müller* does not recite the skin formation time without a catalyst, and it cannot be assumed, i.e. it is not inherent, that the skin formation time would be greater than 40 minutes, as required by the claims. Rather, the method of preparation of the *Müller* polymers leads one skilled in the art to recognize that if *Müller* were to have used an aminomethylalkoxysilane rather than the aminopropylalkoxysilanes used in all his examples, the resulting polymer would have exhibited a skin time of only several minutes, at best.

Müller also does not teach or suggest the claimed invention. *Müller* never recognized that methylene-spaced alkoxysilane groups would have been so much more reactive than those he used, and if he had recognized this, he would have limited the scope of his claims to exclude such species, since there would not be enough time to mix this A component with his B component. Note Example 5, where the A component is mixed with the B component for 30 minutes in order to prepare a sufficiently homogenous composition, which is absolutely necessary for dental impressions. If a methylene-spaced polymer had been used, it is likely that the A component would have solidified during its preparation due to trace amounts of water present in the filler and emulsifier (see page 5, lines 5 - 13 of the present application). But it is certain, with the large amount of water in the B component, plus the acid (proton donor) also present, that reaction would have taken place as soon as the components are mixed, producing an intractable mixture, useless for *Müller's* purposes.

Müller does not teach any method of preparation of his products other than employing an aminoalkylalkoxysilane, and thus could not have discovered that when isocyanatomethylalkoxysilanes are used instead (reverse reaction), or when deactivators are added, that reactivity could be significantly decreased. Actually, *Müller* had no reason to decrease reactivity - he had to add a large amount of proton donor to even ensure reasonable reaction time. He would not want his reaction time to be extended. Anyone who has ever had a dental impression made can attest to this.

Applicants submit, therefore, that the claimed invention is novel over *Müller* and nonobvious as well.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, the Examiner is highly encouraged to telephone Applicants' attorney at the number given below.

Respectfully submitted,

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